OPERATING INSTRUCTIONS

E. G. ARNOLD
BLDG. 3 ROOM
ELECTRONICS PARK
EXT. 2207

TYPE 1212-A

UNIT NULL DETECTOR

GENERAL RADIO COMPANY

782-F

OPERATING INSTRUCTIONS

TYPE 1212-A

UNIT NULL DETECTOR

Form 782-F
May, 1960

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

SPECIFICATIONS

TYPE 1212-A UNIT NULL DETECTOR

Sensitivity: Less than 40 μv input at 1 kc required to deflect meter 1% of full scale.

Voltage Response: See Figure 3.

Power Supply: 325 v dc at 40 ma; 6.3 v ac at 0.9 amp
Type 1203 or 1201 Unit Power Supply recommended.

Frequency Response: See Figure 4.

Accessories Supplied: Type 874 Coaxial Cable Connector, multipoint socket for power supplies other than Unit Power Supplies, and locking strips to attach Unit Power Supply to Null Detector.

Accessory Filters Available: Type 1212-P1 for eliminating low-frequency hum and noise, Type 1212-P2 for use at 1 Mc, Type 1951-A for maximum sensitivity and selectivity at 400 and 1000 cps.

Dimensions: Width 9-1/2 in., height 5-3/8 in., depth 6 in., over-all.

Weight: 5-1/2 lb.

General Radio EXPERIMENTER reference: Vol 27, No. 9, February, 1953.
U. S. Patent No. 2,548,457

TYPE 1212-P1 HIGH-PASS FILTER

Attenuation Characteristics: See Figure 4.

Nominal Load Impedance: One Megohm.

Input Voltage Limit: 150 volts maximum.

Terminals: Type 874 at each end.

Dimensions: Diameter 7/8 in., length 4-3/8 in.

Weight: 3 oz.

General Radio EXPERIMENTER reference: Vol 27, No. 9, February, 1953.
U. S. Patent No. 2,548,457

TYPE 1212-P2 1-MC FILTER

Insertion Gain: When used with Type 716-CS1 Capacitance Bridge and Type 1212-A Unit Null Detector, the insertion gain at 1 Mc varies from 22 db in measurement of 100-$\mu\mu$f capacitors to 32 db with 1000 $\mu\mu$f.

Second-Harmonic Rejection: At least 39 db.

Maximum Input Voltage: 200 volts.

Terminals: Type 874 at each end.

Dimensions: Diameter 2 in., length 5 in.

Weight: 9 oz.

General Radio EXPERIMENTER reference: Vol 30, No. 8, January, 1956.

TYPE 1951-A FILTER

Frequency: 400 and 1000 cps.

Maximum Allowable RMS Input Voltage: Depends on input-impedance range. At 400 cps from 4 to 165 v; at 1000 cps from 10 to 200 v.

Second-Harmonic Rejection: At least 30 db.

Insertion Gain: -15 db to +35 db depending on driving source resistance and frequency.

Accessories Supplied: Type 274-MB Double Plug, Type 274-ND Shielded Plug, Type 874-Q6 Adaptor.

Dimensions: 3-1/8 by 3-1/4 by 4-3/8 in., over-all.

Weight: 1-3/4 lb.

General Radio EXPERIMENTER reference: Vol 27, No. 9, February, 1953.

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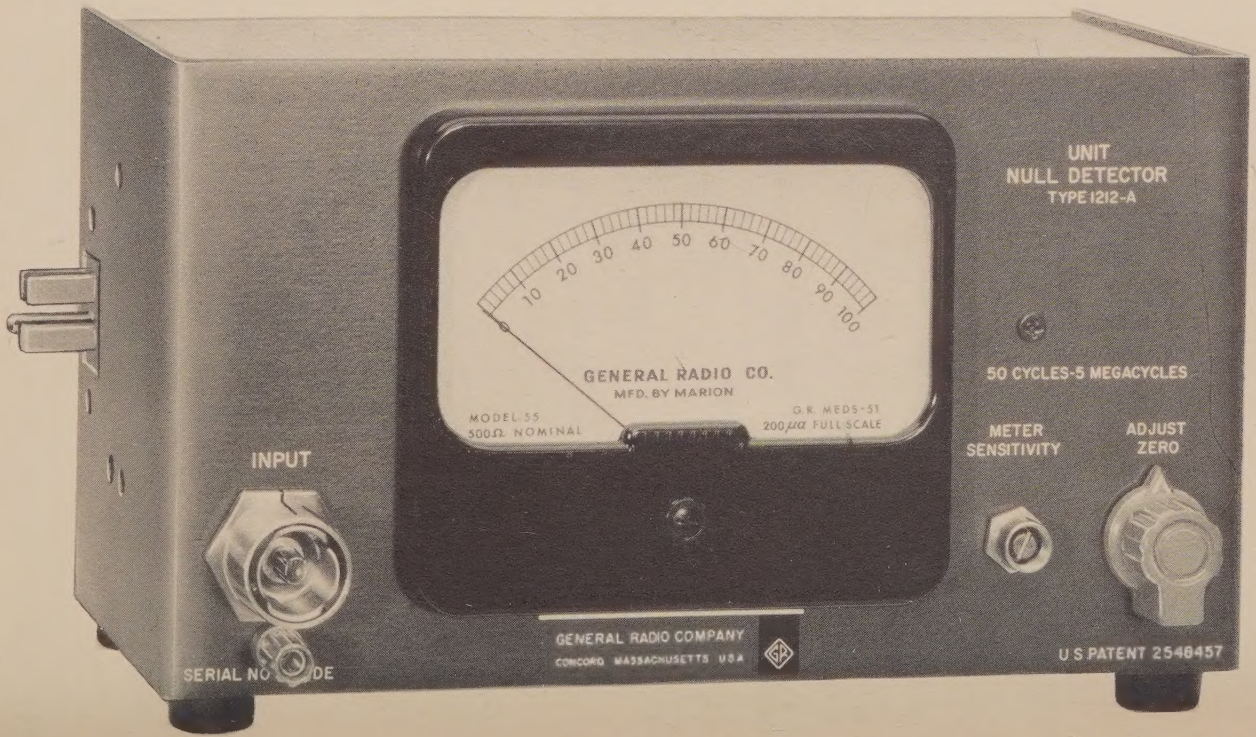


Figure 1. Type 1212-A Unit Null Detector.

TYPE 1212-A
UNIT NULL DETECTOR

Section 1
INTRODUCTION

1.1 PURPOSE. The Type 1212-A Unit Null Detector (Figure 1) is a logarithmic amplifier used primarily as a balance indicator for a-c bridge measurements from 50 cycles to 5 megacycles. With suitable input filters, the Unit Null Detector can be used with the Type 716-C Capacitance Bridge, Type 667-A Inductance Bridge, Type 1661-A Vacuum-Tube Bridge, Type 916-AL R-F Bridge, Type 716-CS1 Capacitance Bridge, and up to 5 Mc with the Type 1606-A R-F Bridge and Type 821-A Twin-T Impedance-Measuring Circuit.

1.2 DESCRIPTION.

1.2.1 GENERAL. The Unit Null Detector is a three-stage, wide-band, pentode amplifier with a maximum gain of about 70 db. As shown in the elementary schematic diagram (Figure 2), a pair of germanium crystal diodes are connected back-to-back in the output of each stage to obtain a quasilogarithmic input-output characteristic. When the voltage on a pair of diodes is low the impedance is high and the gain of the associated stage is at maximum. Three of these stages are cascaded to produce the quasilogarithmic response over a wide

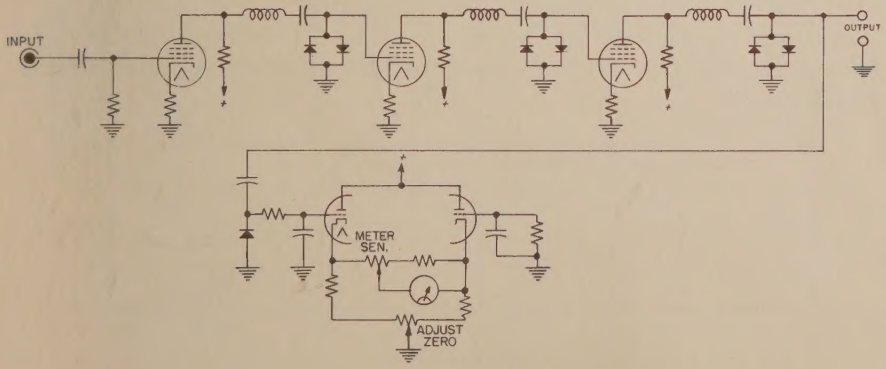


Figure 2. Elementary Schematic Diagram.

range of input voltages. At fairly low input voltages the third-stage diodes begin to reduce the gain of the amplifier. As the input voltage is increased, the second-stage and first-stage diodes also begin to reduce over-all gain. When the input voltage is increased beyond a few volts, the first stage draws grid current. This puts negative bias on the first tube, further reducing the over-all gain.

Because of the crystal diodes the second and third stages can never draw grid current.

The output is usually distorted because of the clipping action of the crystal diodes. At low signal levels the distortion is negligible, but at high signal levels the output is approximately a square wave.

Direct current is used on the filament on the first 6AK5 to reduce internal pickup of power-line frequencies. Regulated plate and screen voltages throughout reduce effects of line-voltage variation.

1.2.2 CONTROLS. The front-panel controls are the ADJUST ZERO control, a potentiometer which establishes electrical zero on the meter, the METER SENSITIVITY screw-driver adjustment, used to establish a full-scale reference with maximum voltage applied, and the mechanical zero adjustment for the meter.

1.2.3 CONNECTORS. On the front panel of the Unit Null Detector is a Type 874 coaxial input connector. A jack-top binding post directly below the coaxial connector permits input connection by means of either the Type 874 Coaxial Connector supplied or a Type 274 Double Plug. At the rear of the instrument, a pair of Type 274 Jacks permit connection to headphones for aural null indication. The power input connector is on the left side of the instrument, and the Null Detector and companion Unit Power Supply can be attached to each other directly, without the need of intermediate cable.

1.3 ACCESSORIES. Supplied with the Type 1212-A Unit Null Detector are a multipoint connector matching the power input connector and a Type 874 Coaxial Cable Connector for the signal input connection.

Available for use with the Unit Null Detector are the Type 1212-P1 High-Pass Filter, the Type 1212-P2 1-Mc Filter, and Type 1951-A Filter (refer to paragraph 2.3).

Section 2
OPERATING PROCEDURE

2.1 POWER SUPPLY. The Unit Null Detector may be firmly attached to a Unit Power Supply by means of two locking strips provided. These strips fit over the top and bottom edges of the cabinets, sliding in place from the rear. The Unit Null Detector and Unit Power Supply are equipped with matching power connectors that eliminate the need for an interconnecting cable.

Of course, any other power supply capable of furnishing 325 volts dc at 40 ma and 6.3 volts ac at 0.9 ampere may be used with the Unit Null Detector. A multipoint connector is supplied for connection to the Unit Null Detector.

2.2 OPERATION. Turn the power supply on and allow a few minutes warmup time. Then short-circuit the null detector input at the front panel and zero the meter using the ADJUST ZERO adjust. The instrument is now ready for use.

The meter has an approximately logarithmic response to input voltage up to 100 volts, as shown in Figure 3. Frequency response in decibels is given in Figure 4.

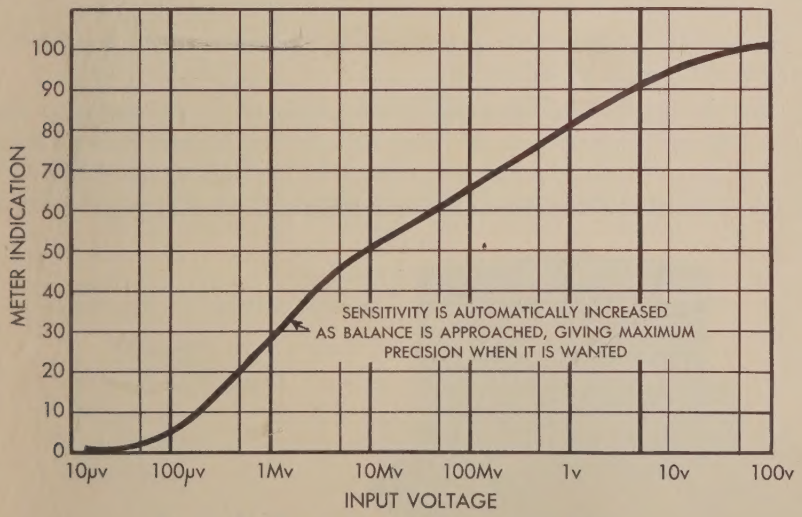


Figure 3. Typical Voltage-Response Curve.

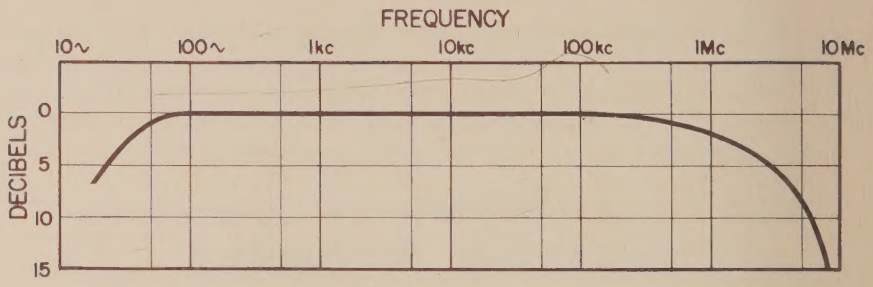


Figure 4. Typical Frequency-Response Curve.

The METER SENSITIVITY screw-driver adjustment has a small effect on the maximum sensitivity of the null detector and a very large effect on the voltage required to drive the meter offscale. Adjust this control so that the meter reads full-scale (or as far upscale as possible) with the maximum voltage to be used applied to the input of the null detector. This provides maximum sensitivity at null without running the meter offscale when not at null.

An aural null indication is often preferable to a visual indication, especially when the signal being detected is very noisy, as the ear can discriminate against noise much better than can a meter. The aural indication is also about 20 db more sensitive, and should be used for maximum sensitivity at audio frequencies. The headphones are connected through the Type 274 Jacks at the rear of the instrument. The headphones also make it easy to identify residual signals, especially when they are caused by hum picked up by the device under test.

The use of high-impedance headphones is recommended, as they have the smallest effect on meter indication.

2.3 USE WITH FILTERS. When the characteristic of a tuned circuit at either 400 or 1000 cycles is desired, the Type 1951-A Filter (Figure 5) is recommended. Operating in front of a high-gain amplifier, this filter eliminates large-amplitude spurious signals such as 60-cycle pickup before they can overload the

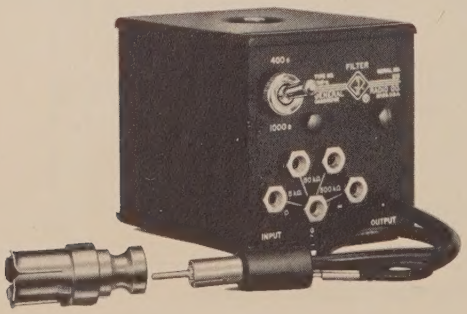


Figure 5.
Type 1951-A Filter.

amplifier. This feature is particularly useful in three-terminal measurement of direct capacitance, or other measurements where portions of the circuit under test are floating above ground and subject to pickup of external voltages.

When the Type 1951-A Filter is used with the Unit Null Detector, the filter input tap providing greatest sensitivity should generally be used. If selectivity is more important than sensitivity, the selectivity can be increased somewhat by use of a lower-impedance tap than that producing greatest sensitivity.

When the filter is used in front of a high-gain amplifier such as the Unit Null Detector, spurious pickup from strong local fields (such as the Unit Null Detector's own power supply) may affect the filter. This effect can be eliminated, however, by proper orientation of the filter.

For measurements above 10 kc, the Type 1212-P1 Filter (Figure 6) is recommended for elimination of low-frequency noise and hum. Attenuation characteristics are shown in Figure 7.

The Type 1212-P2 1-Mc Filter (Figure 8) is recommended for use with the Unit Null Detector for 1-Mc measurements with the Type 716-CS1 Capacitance Bridge, Type 916-AL R-F Bridge, and Type 1606-A R-F Bridge.

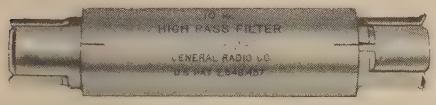


Figure 6.
Type 1212-P1
High-Pass Filter.

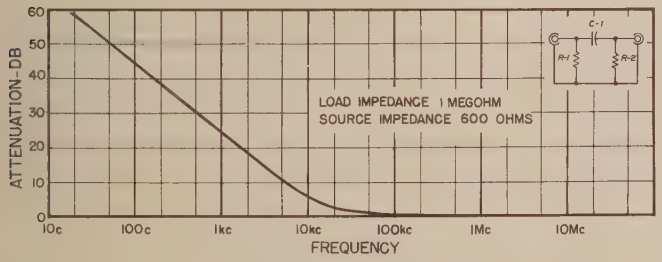
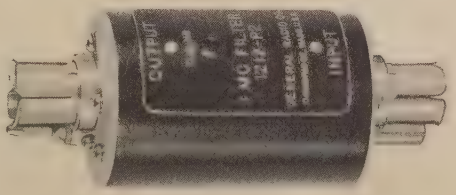


Figure 7.
Attenuation Characteristics of Type 1212-P1 High-Pass Filter.

Figure 8.
Type 1212-P2
1-Mc Filter.



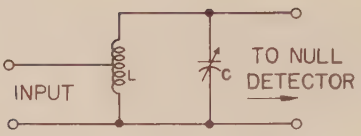


Figure 9.
General-Purpose Filter Circuit.

A general-purpose filter circuit for elimination of harmonics, etc, can be easily constructed as shown in Figure 9. The tap on the coil should be determined by the impedance seen on the input side of the filter, since this will affect both insertion gain and Q of the filter. The variable condenser allows tuning over a range of frequencies. The entire filter should be enclosed by a shield can.

Section 3
SERVICE AND MAINTENANCE

3.1 GENERAL. The two-year warranty given with every General Radio instrument attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible.

In case of difficulties that cannot be eliminated by the use of these service instructions, please write or phone our Service Department, giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office (see back cover), requesting a Returned Material Tag. Use of this tag will insure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

3.2 CRYSTAL-DIODE REPLACEMENT. If the input voltage required for full-scale deflection of the meter is much less than normal, or if maximum sensitivity is low, especially at low frequencies, one of the crystal diodes may not be functioning properly. Remove the crystals and check them with a battery-operated ohmmeter (Weston model 663 or equivalent). The forward resistance should be less than 700 ohms, and the back resistance greater than 100

kilohms. When replacing crystals, including the voltmeter rectifier crystal, be sure to observe proper polarity, and be careful not to damage the crystals by heat when soldering.

3.3 TUBE TEST VOLTAGES. The following voltages were measured with a 20,000-ohm-per-volt meter, between tube pins and ground. Voltages are dc except where otherwise indicated, and may vary by 20 percent.

TUBE (TYPE)	PIN	VOLTS	TUBE (TYPE)	PIN	VOLTS	TUBE (TYPE)	PIN	VOLTS
V1 (6AK5)	2	2.0	V3 (6AK5)	2	2.4	V5 (12AX7)	1	145
	3	0		3	0		3	1.5
	4	6.0		4	6.3 AC		4	6.3 AC
	5	102		5	120		5	6.3 AC
	6	125		6	137		6	145
	7	2.0		7	2.4		7	0
V2 (6AK5)	2	2.3	V4 (0A2)	5	145		8	1.5
	3	0					9	0
	4	6.3 AC						
	5	112						
	6	132						
	7	2.3						

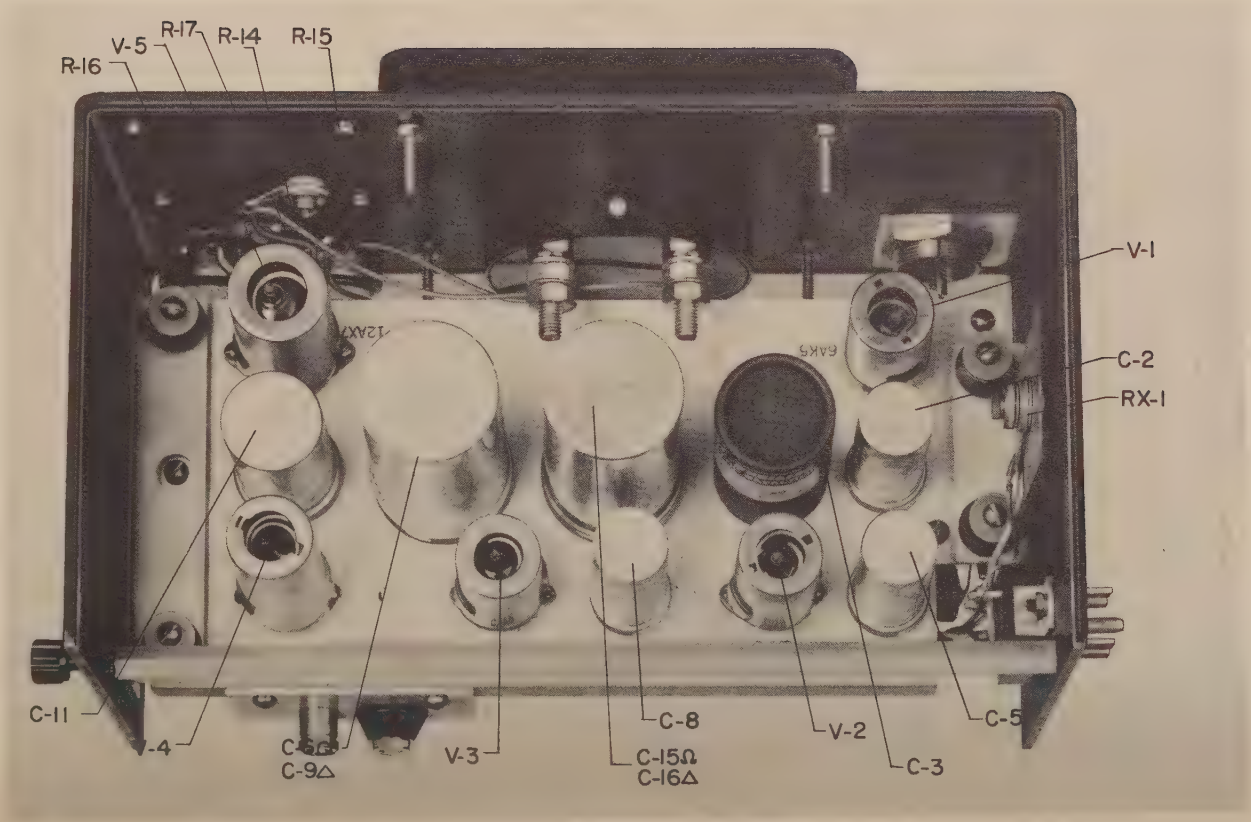


Figure 10. Top Interior View.

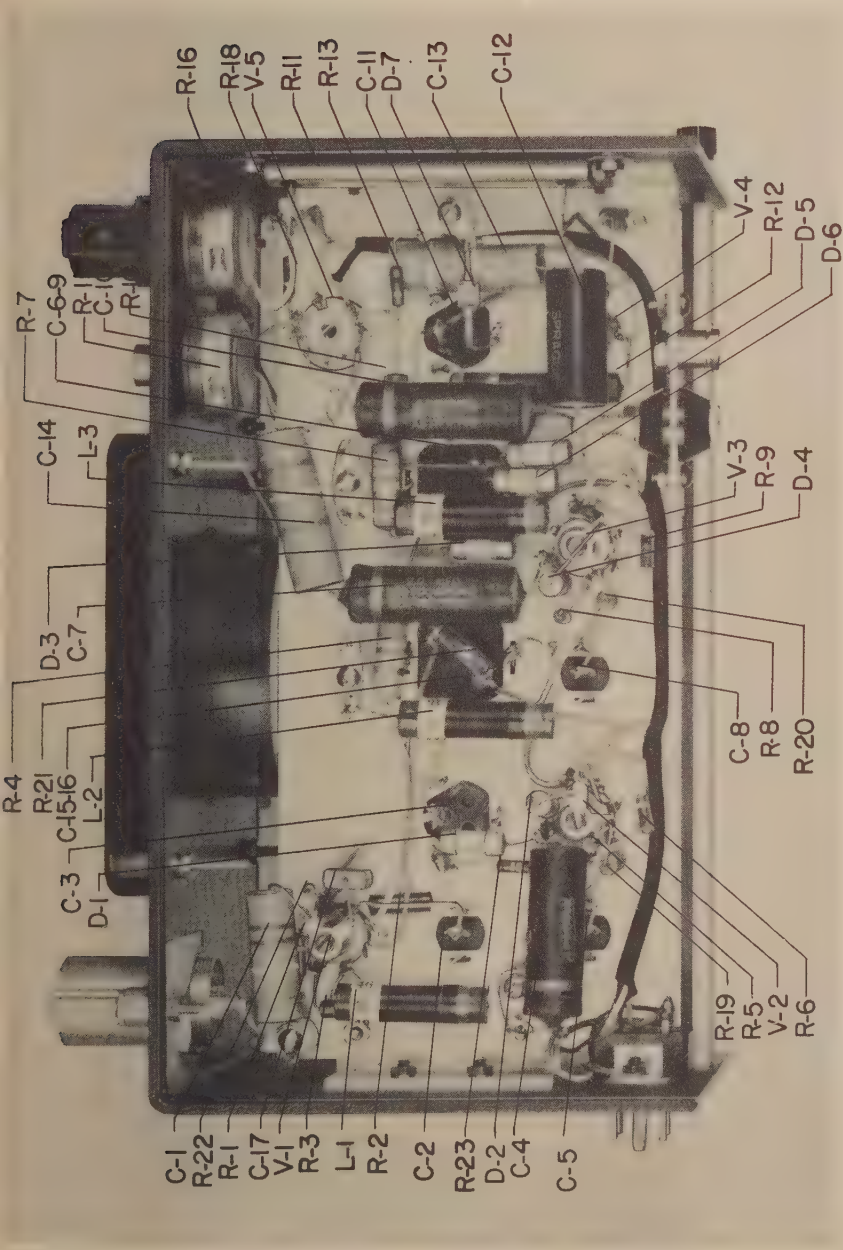


Figure 11. Bottom Interior View.

PARTS LIST

					PART NO. (NOTE A)
RESISTORS (NOTE B)	R1	1M	±10%	½ w	REC-20BF
	R2	200	±5%	½ w	REC-20BF
	R3	3.3k	±5%	½ w	REC-20BF
	R4	680	±10%	1 w	REC-30BF
	R5	270	±5%	½ w	REC-20BF
	R6	3.6k	±5%	½ w	REC-20BF
	R7	680	±10%	1 w	REC-30BF
	R8	330	±5%	½ w	REC-20BF
	R9	3.6k	±5%	½ w	REC-20BF
	R10	1k	±10%	1 w	REC-30BF
	R11	4k	±10%		REPO-21P
	R12	360	±5%	2 w	REC-41BF
	R13	1M	±10%	½ w	REC-20BF
	R14	3k	±5%	½ w	REC-20BF
	R15	5k	±10%		POSC-11
	R16	2.5k	±10%		POSC-7
	R17	3k	±5%	½ w	REC-20BF
	R18	1M	±10%	½ w	REC-20BF
	R19	15	±5%	½ w	REC-20BF
	R20	15	±5%	½ w	REC-20BF
	R21	2.7	±10%	½ w	REW-3C
	R22	1M	±10%	½ w	REC-20BF
	R23	12k	±10%	½ w	REC-20BF
	R24	1.8k	±10%	½ w	REC-20BF
	R25	100	±10%	½ w	REC-20BF
	R26	100	±10%	½ w	REC-20BF
	R27	160k	±10%	½ w	REC-20BF
	C1	0.022	±10%	600 dcwv	COL-71
	C2	200		6 dcwv	COE-22
	C3	40		200 dcwv	COE-29
	C4	2	±20%	200 dcwv	COL-70

					PART NO. (NOTE A)
CAPACITORS (NOTE C)	C5	200		6 dcwv	COE-22
	C6	40		450 dcwv	Part of COEB-17
	C7	2	±20%	200 dcwv	COL-70
	C8	200		6 dcwv	COE-22
	C9	40		450 dcwv	Part of COEB-17
	C10	2	±20%	200 dcwv	COL-70
	C11	20		450 dcwv	COE-5
	C12	1	±10%	100 dcwv	COW-17
	C13	0.047	±10%	600 dcwv	COL-71
	C14	0.047	±10%	600 dcwv	COL-71
	C15	1500		10 dcwv	COE-9
	C16	1500		10 dcwv	
	C17	100 μμf	±10%	500 dcwv	COM-20B
	D1	CRYSTAL DIODE			1N35
	D2	CRYSTAL DIODE			
	D3	CRYSTAL DIODE			1N35
	D4	CRYSTAL DIODE			
	D5	CRYSTAL DIODE			1N35
	D6	CRYSTAL DIODE			
	D7	CRYSTAL DIODE			1N54-A
	L1	CHOKE, 60 μh	±5%		ZCHA-46
	L2	CHOKE, 60 μh	±5%		ZCHA-46
	L3	CHOKE, 60 μh	±5%		ZCHA-46
	M1	METER, 200 μa			MEDS-116
	RX1	RECTIFIER			2RE-18
	V1	TUBE			6AK5
	V2	TUBE			6AK5
	V3	TUBE			6AK5
	V4	TUBE			0A2
	V5	TUBE			12AX7

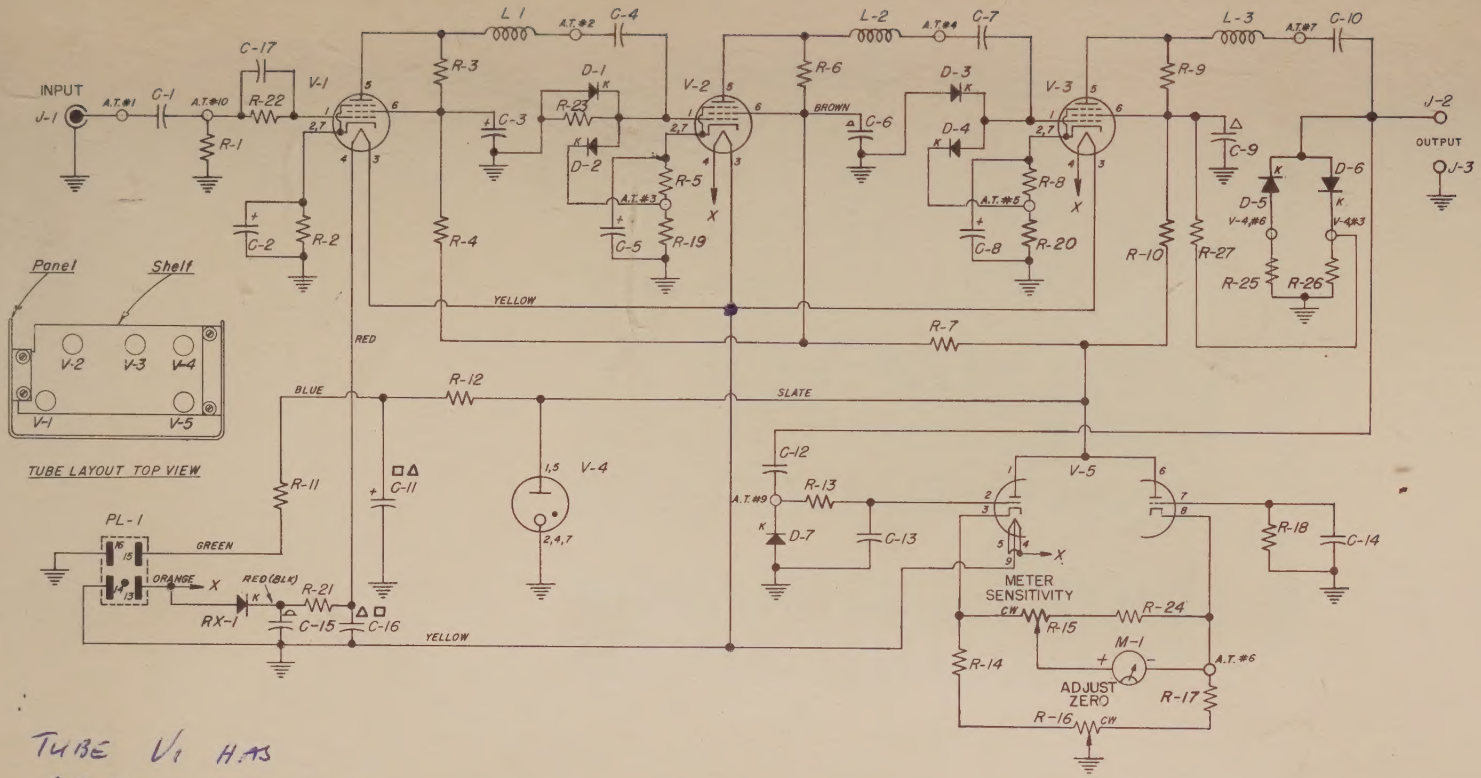
NOTES:

(A) GR Part No. designations for resistors and capacitors are as follows:

COE - Capacitor, electrolytic
COEB - Capacitor, electrolytic block
COL - Capacitor, oil
COM - Capacitor, mica
COW - Capacitor, wax
POSC - Potentiometer, composition
REC - Resistor, composition
REPO - Resistor, power
REW - Resistor, wire-wound

(B) All resistances are in ohms, except as otherwise indicated by k (kilohms) or M (megohms).

(C) All capacitances are in microfarads, except as otherwise indicated by μμf (micromicrofarads).



TUBE V1 HAS
6V DC FILAMENT

Figure 12. Schematic Diagram.

GENERAL RADIO UNIT INSTRUMENTS

Type 1201	Unit Regulated Power Supply	
Type 1203	Unit Power Supply	
Type 1204	Unit Variable Power Supply	
Type 1205	Adjustable Regulated Power Supply	
Type 1206	Unit Amplifier	
Type 1208	Unit Oscillator	65 to 500 Mc
Type 1209-B	Unit Oscillator	250 to 920 Mc
Type 1209-BL	Unit Oscillator	180 to 600 Mc
Type 1210	Unit RC Oscillator	20 cps to .5 Mc
Type 1211	Unit Oscillator	0.5 to 50 Mc
Type 1212	Unit Null Detector	
Type 1213	Unit Time/Frequency Calibrator	
Type 1214-A	Unit Oscillator	400 and 1000 cps
Type 1214-D	Unit Oscillator	120 cps
Type 1214-E	Unit Oscillator	270 and 1000 cps
Type 1214-M	Unit Oscillator	1 Mc
Type 1215	Unit Oscillator	50 to 250 Mc
Type 1216	Unit I-F Amplifier	
Type 1217	Unit Pulser	
Type 1218	Unit Oscillator	900 to 2000 Mc
Type 1219	Unit Pulse Amplifier	
Type 1220	Unit Klystron Oscillator	

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